FORM PTO 1390
(REV 11-98) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: LAGROTH-026

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 09/890139

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATES	PRIORITY DATE CLAIMED
PCT/SE00/00187	31 January 2000	1 February 1999

TITLE OF INVENTION: METHOD AND ARRANGEMENT FOR THE PRODUCTION OF LIGNOCELLULOSE-CONTAINING BOARDS

APPLICANT(S) FOR DO/EO/US: N. Lennart ERIKSSON, et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [X] This is an express request to promptly begin national examination procedures (35 U.S.C. 371 (f)).
4. [X] The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. [X] A copy of the International Application as filed (35 U.S.C. 371 (c)(2))
   a. [ ] is attached hereto (required only if not transmitted by the International Bureau).
   b. [X] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [ ] An English language translation of the International Application as filed (35 U.S.C. 371 (c)(2)).
7. [X] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [X] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)). (Unexecuted)
10. [ ] An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. [X] An Information Disclosure Statement under 37 CFR 1.97 and 1.98. w/PTO-1449, 2 references
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 & 3.31 is included.
13. [X] A FIRST preliminary amendment.
    [ ] A SECOND or SUBSEQUENT preliminary amendment.
14. [X] A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [X] Other items or information:

    Substitute Abstract
    Marked-up Specification
    Copy of International Application as published
    Copy of International Preliminary Examination Report W/Annexes
    One (1) Sheet Formal Drawing

EXPRESS MAIL LABEL NO. __EL807550865US_____
DATE: ____July 26, 2001_____

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/890139	PCT/SE00/00187	LAGROTH-026

17. [X] The following fees are submitted: — **CALCULATIONS** PTO USE ONLY

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) – (5)):

- [X] Neither international preliminary examination fee (37 CFR 1 482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $1,000 00
- [ ] International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $860.00
- [ ] International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1 445(a)(2)) paid to USPTO $710.00
- [ ] International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) $690.00
- [ ] International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) $100 00

ENTER APPROPRIATE BASIC FEE AMOUNT =				1,000.00	
Surcharge of $130.00 for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).					
CLAIMS	**NUMBER FILED**	**NUMBER EXTRA**	**RATE**		
Total claims	*5- 20		x $18.00		
Independent claims	2- 3 =		x $80.00		
MULTIPLE DEPENDENT CLAIM(s) (if applicable)			+ $270.00		
TOTAL OF ABOVE CALCULATIONS =				1,000.00	
[ ] Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by ½.					
SUBTOTAL =				1,000.00	
Processing fee of $130.00 for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +					
TOTAL NATIONAL FEE =				1,000.00	
Fee for recording the enclosed assignment (37 CFR 1.21 (h)). Assignment must be accompanied by appropriate cover sheet (37 CFR 3.28, 3.31) ($40.00 per property). +					
TOTAL FEES ENCLOSED =				1,000.00	

*As In Preliminary Amendment

Amount to be:
Refunded
Charged

a. [ ] A check in the amount of ________ to cover the above fees is enclosed.

b. [x] Please charge my Deposit Account No. 12-1095 in the amount of $ 1,000.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [x] The Commissioner is hereby authorized to charge any additional fees which may be required or credit any overpayment to my Deposit Account No. 12-1095 . A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Lerner, David, Littenberg,
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Signature

ARNOLD H. KRUMHOLZ
Name

25,428
Registration Number

PATENT
LAGROTH 3.3-026

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of N. Lennart ERIKSSON *et al.*	
	Group Art Unit:
International Application No. PCT/SE00/00187	Examiner:
International Filing Date: 31 January 2000	Date: July 26, 2001
For: METHOD AND ARRANGEMENT FOR THE PRODUCTION OF LIGNOCELLULOSE-CONTAINING BOARDS	

Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Preliminary to initiation of the prosecution of the above-identified pending U.S. patent application, the following amendments and remarks are respectfully submitted.

IN THE ABSTRACT

Please delete the Abstract as filed and substitute therefor the attached revised Abstract.

IN THE SPECIFICATION

Please amend the Specification in accordance with the attached revised Specification.

IN THE CLAIMS

Please cancel claims 1-5 and add new claims 6-10.

6. (NEW) A method for continuously producing lignocellulose-containing boards comprising providing a mat of disintegrated, glue-coated and dried lignocellulose-containing material, pressing said mat into a board in a steam injection press, conditioning said board by drawing a predetermined volume of air having a predetermined moisture content at a predetermined temperature through said board by means of suction applied

through said board, and grinding said conditioned board to a final thickness directly following said conditioning step.

7. (NEW) The method of claim 6 wherein said conditioning of said board comprises a first conditioning of said board by drawing a first predetermined volume of air having a first predetermined moisture content at a first predetermined temperature through said board in a first direction by means of suction applied through said board, and including a second conditioning of said board by drawing a second predetermined volume of air having a second predetermined moisture content at a second predetermined temperature through said board in a second direction by means of suction applied through said board, wherein said second direction is opposite to said first direction.

8. (NEW) The method of claim 6 wherein said pressing of said mat into said board provides a board having a pair of surface layers and a center layer, and wherein said pair of surface layers and said center layer have substantially the same density.

9. (NEW) Apparatus for continuously providing lignocellulose-containing boards from a mat of disintegrated, glue-coated and dried lignocellulose-containing material, said apparatus comprising a steam injection press for pressing said mat into a board, conditioning means comprising an air supply unit for passing said air through said board as said board passes through a conditioning zone, and a grinder for grinding said conditioned board to a final thickness directly following said conditioning zone.

10. (NEW) The apparatus of claim 9 wherein said conditioning means comprises first conditioning means comprising a first air supply unit for passing said air through said board in a first direction and including second conditioning means comprising a second air supply unit for passing said air through said board in a second direction, said second direction being opposite to said first direction.

REMARKS

The above-noted cancellation of claims 1-5, and addition of new claims 6-10, as well as the submission of a new Abstract and revisions to the Specification, are respectfully submitted prior to initiation of the prosecution of this application in the U.S. Patent and Trademark Office.

The above-noted new claims are respectfully submitted in order to more clearly and appropriately claim the subject matter which applicants consider to constitute their inventive contribution. No new matter is included in these amendments. In addition, the revisions to the Abstract and Specification are submitted in order to clarify and correct the Abstract and Specification and to conform them to all of the requirements of U.S. practice. No new matter is included in these amendments.

In view of the above, it is respectfully requested that these amendments now be entered, and that prosecution on the merits of this application now be initiated. If, however, for any reason the Examiner does not believe such action can be taken, it is respectfully requested that he telephone applicant's attorney at (908) 654-5000 in order to overcome any objections which he may have.

If there are any additional charges in connection with this requested amendment, the Examiner is authorized to charge applicant's Deposit Account No. 12-1095 therefor.

Respectfully submitted,

LERNER, DAVID, LITTENBERG,
KRUMHOLZ & MENTLIK, LLP

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319393_1.DOC

METHOD AND ARRANGEMENT FOR THE PRODUCTION OF LIGNOCELLULOSE-CONTAINING BOARDS

FIELD OF THE INVENTION

[0001] The present invention relates to a method for continuously producing lignocellulose-containing boards. More particularly, the present invention relates to apparatus for carrying out such a method.

BACKGROUND OF THE INVENTION

[0002] Methods of producing lignocellulose-containing board are well known in the art, and have found wide use in practice. The manufacture of such boards includes the following main steps: disintegration of the raw material into particles and/or fibers of appropriate size, drying the particles and/or fibers to a predetermined moisture quotient, and glue-coating the material either prior to or subsequent to the drying process, shaping the glue-coated material to form a mat, which may comprise several layers, and optionally cold pre-pressing the mat, preheating the mat, water-spraying mat surfaces, etc., and heat pressing the mat in a discontinuous press or in a continuous press while simulataneously subjecting the material to heat and pressure so as to obtain a finished board. It is difficult to control the quality of the boards produced in accordance with this known method with respect to the moisture content, temperature and dimensional stability of the boards. When the boards leave the heat pressing state of the production process, they have a temperature in excess of 100°C and a corresponding vapor pressure. The temperature of the board surfaces falls rapidly to beneath 100°C as the enclosed moisture is vaporised by virtue of a so-called flash effect. The boards are then cooled in cooling wheels. As a result, the boards will obtain a moisture content of about 6% to 7% after intermediate storage of the board over a period of a day or two. In many applications this creates a problem, particularly in environments which have a higher average relative humidity, since the boards will take up moisture when used and thus

undergo dimensional changes, as in the case of all lignocellulose-containing materials. One way of counteracting this is to spray water on the boards as they leave the press.

[0003] Another known phenomenon is that boards produced in this manner obtain different moisture contents in the surface layers relative to the core layer. If the boards are used for some type of surface treatment, for instance, such as lamination, without having earlier equalised the difference in moisture content, the dimensions of the board may change when this equalisation takes place, so that the surface layer loosens. In order to achieve desired equalisation between the various layers, it is customary to thus store the boards for a number of weeks.

[0004] Another known problem is that the boards are not dimensionally stable when they leave the press. This is noticeable primarily because the boards shrink or swell over a process that can take one or more days. Consequently, calibration grinding of the boards is not normally undertaken until the boards have been stored in intermediate storage locations over a number of days.

[0005] Another known problem is that the boards are too hot to be stacked and stored when leaving the hot press. If the boards are too hot when stacked, the glue joints may begin to break down, and the boards will consequently be weakened. This problem is normally alleviated by keeping the boards in a cooling wheel, in which the board temperature is lowered by natural convection.

[0006] It will be evident from the aforegoing that the conventionally used press and board production techniques involve a number of cost-inducing handling stages and intermediate storage subsequent to the actual board manufacturing process. Accordingly, one object of the present invention is to stabilise a board with respect to its moisture content, temperature and dimensional stability in a continuous process, and in that manner avoid cost-inducing handling and storage of the board. Because dimensional stability is

achieved, the boards may also be ground or sanded down to a final thickness directly after manufacture.

SUMMARY OF THE INVENTION

[0007] In accordance with the present invention, these and other objects have now been realized by the invention of a method for continuously producing lignocellulose-containing boards comprising providing a mat of disintegrated, glue-coated and dried lignocellulose-containing material, pressing the mat into a board in a steam injection press, conditioning the board by drawing a predetermined volume of air having a predetermined moisture content at a predetermined temperature through the board by means of suction applied through the board, and grinding the conditioned board to a final thickness directly following the conditioning step. In a preferred embodiment, the conditioning of the board comprises a first conditioning of the board by drawing a first predetermined volume of air having a first predetermined moisture content at a first predetermined temperature through the board in a first direction by means of suction applied through the board, and including a second conditioning of the board by drawing a second predetermined volume of air having a second predetermined moisture content at a second predetermined temperature through the board in a second direction by means of suction applied through the board, wherein the second direction is opposite to the first direction.

[0008] In accordance with one embodiment of the method of the present invention, the pressing of the mat into the board provides a board having a pair of surface layers and a center layer, and wherein the pair of surface layers and the center layer have substantially the same density.

[0009] In accordance with the present invention, these and other objects have also been realized by the invention of apparatus for continuously providing lignocellulose-containing boards from a mat of disintegrated, glue-coated and dried lignocellulose-containing material, the apparatus comprising a steam injection press for pressing the mat into a board,

conditioning means comprising an air supply unit for passing the air through the board as the board passes through a conditioning zone, and a grinder for grinding the conditioned board to a final thickness directly following the conditioning zone. In a preferred embodiment, the conditioning means comprises first conditioning means comprising a first air supply unit for passing the air through the board in a first direction and including second conditioning means comprising a second air supply unit for passing the air through the board in a second direction, the second direction being opposite to the first direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present invention will now be described in more detail with reference to the following detailed description which, in turn, refers to the accompanying drawing, in which:

[0011] The figure is a side, elevational, longitudinal sectional view of a plant constructed in accordance with the present invention.

DETAILED DESCRIPTION

[0012] The plant illustrated in the drawing is based on the plant disclosed in Swedish Patent No. 504,638, which describes a continuous steam injection process. Turning to the drawing, a mat 1 formed from lignocellulose-containing material is fed into a continuous steam injection press 2 and pressed into boards 3 therein. The boards exiting from the continuous steam injection press 2 enter an after-conditioning zone 4. In the illustrated example, the zone 4 includes two after-conditioning units, 5 and 6. The boards can be transferred directly to a grinder 7 from the after-conditioning zone 4, for grinding of the board to a final thickness.

[0013] In accordance with the present invention, each after-conditioning unit, 5 and 6, comprises an air supply unit 8 that includes a suction fan 9 and a heater 10. A steam or water supply device 11 may also be provided for moistening the air. The air is sucked into the two air supply units at 12. As will be seen from the drawing, the air is delivered from above

in the case of after-conditioning unit 5, and from beneath in the case of after-conditioning unit 6.

[0014] Thus, as the boards exit from the continuous steam injection press 2 they pass into the after-conditioning zone 4 in which air is sucked through the boards with the aid of negative pressure in an amount determined in relation to board production and at a specific moisture content and temperature. In the first after-conditioning unit 5, the air is sucked down through the board, whereas in the after-conditioning unit 6 the air is sucked through the board in the opposite direction, i.e. upwards. However, this double air flow in mutually opposite directions is not necessary in order to achieve the desired effect, since in certain cases the throughflow of air in only one direction will suffice, meaning that only one after-conditioning unit will be required.

[0015] It can be mentioned by way of example that a board having a density of 600 kg/m^3 and a thickness of 16.6 mm is cooled from 100 to 60°C in 60 seconds when applying a subpressure of 15 kPa. By way of another example, a board having a density of 600 kg/m^3 and a thickness of 32 mm can be correspondingly cooled in 80 seconds.

[0016] It will also be noted that a board having a thickness of 10 mm and a density of 650 kg/m^3 and produced in accordance with the present invention in a pilot plant obtained a stable thickness after having passed through the after-conditioning zone. Measurements made one or more days after manufacture showed that boards which had passed through the after-conditioning zone retained their thickness, whereas boards that had not passed through that zone were often liable to shrink up to 1 mm within a day or two, in the same way that conventionally manufactured board also shrinks.

[0017] Conventionally produced boards have an enhanced density at their surfaces. However, because it is possible to produce boards in the steam injection press that do not have an enhanced surface density, the air throughflow and therewith conditioning of the board and lowering of its temperature can

be effected more quickly than in the case of conventional board handling techniques.

[0018] Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.

09/890139
JC18 Rec'd PCT/PTO 26 JUL 2001

ABSTRACT OF THE DISCLOSURE

Methods and apparatus for continuously producing lignocellulose-containing boards are provided. The methods include providing a mat of disintegrated, glue-coated and dried lignocellulose-containing material, pressing the mat into a board in a steam injection press, conditioning the board by drawing air at a predetermined moisture content and temperature through the board by means of suction applied through the board and grinding the conditioned board to a final thickness directly following the conditioning step.

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METHOD AND ARRANGEMENT FOR THE PRODUCTION OF LIGNOCELLULOSE-CONTAINING BOARDS

FIELD OF THE INVENTION

[0001] The present invention relates to a method ~~of producing~~ for continuously producing lignocellulose-containing boards. More particularly, the present invention relates ~~in accordance with the preamble of claim 1, and~~ to apparatus ~~an arrangement~~ for carrying out such a ~~the~~ method ~~in accordance with the preamble of claim 5~~.

BACKGROUND OF THE INVENTION

[0002] Methods of producing lignocellulose-containing board are well known ~~in to~~ the art, and have found wide use in practice. The manufacture of such boards includes the following main ~~method~~ steps: disintegration of the raw material into particles and/or ~~fibres~~ fibers of appropriate size, drying the particles and/or ~~fibres~~ fibers to a predetermined moisture quotient, and glue-coating the material either prior to or subsequent to the ~~said~~ drying process, shaping the glue-coated material to form a mat, which may comprise several layers, and optionally cold pre-pressing the mat, preheating the ~~said~~ mat, water-spraying mat surfaces, etc., and heat pressing the mat in a discontinuous press or in a continuous press while simulataneously subjecting the material ~~simultaneously~~ to heat and pressure ~~and heat~~ so as to obtain a finished board. It is difficult to control the quality of the boards produced in accordance with this known method with respect to the moisture content, temperature and dimensional stability of the boards. When the boards leave the heat pressing state of ~~in~~ the production process, they have a temperature in excess of 100°C and a corresponding ~~vapour~~ vapor pressure. The temperature of the board surfaces falls rapidly to beneath 100°C as the enclosed moisture is vaporised by virtue of a so-called flash effect. The boards are then cooled in ~~so-called~~ cooling wheels. As a result, the boards will obtain a moisture content of about 6~~%~~ to 7% after intermediate storage of the board over a period of a day or

two. In many applications this creates a problem, particularly in environments which ~~that~~ have a higher average relative humidity, since the boards will take up moisture when used and thus ~~therewith~~ undergo dimensional changes, as in the case of all lignocellulose-containing materials. One way of counteracting this is to spray water on the boards as they leave the press.

[0003] Another known phenomenon ~~phenomena~~ is that boards produced in this manner ~~way~~ obtain ~~mutually~~ different moisture contents in the surface layers relative to the core layer. If the boards are used for some type of surface treatment, for instance, such as lamination, without having earlier equalised the difference in moisture content, the dimensions of the board may change when this equalisation takes place, ~~in time~~ so that the surface layer loosens. In order to achieve desired equalisation between the various layers, it is customary to thus store the boards for a number of weeks.

[0004] Another known problem is that the boards are not dimensionally stable when they leave the press. This is noticeable primarily because the boards shrink or swell over a process that can take one or more days. Consequently, calibration grinding of the boards is not normally undertaken until the boards have been stored in intermediate storage locations over a number of days.

[0005] Another known problem is that the boards are too hot to be stacked and stored when leaving the hot press. If the boards are too hot when stacked, the glue joints may begin to break down, and the boards will consequently be weakened. This problem is normally alleviated by keeping the boards in a ~~so-called~~ cooling wheel, in which the board temperature is lowered by natural convection.

[0006] It will be evident from the aforegoing that the conventionally used press ~~technique~~ and board production techniques involve a number of cost-inducing handling stages and intermediate storage subsequent to the actual board manufacturing process. Accordingly, ~~the~~ one object of the

present invention is to stabilise a board with respect to its moisture content, temperature and dimensional stability in a continuous process, and in that manner ~~therewith~~ avoid cost-inducing handling and storage of the board. Because dimensional stability is achieved, the boards may also be ground or sanded down to a final thickness directly after manufacture. ~~This object is achieved with the method and the apparatus defined in the characterizing clauses of respective claims.~~

SUMMARY OF THE INVENTION

[0007] In accordance with the present invention, these and other objects have now been realized by the invention of a method for continuously producing lignocellulose-containing boards comprising providing a mat of disintegrated, glue-coated and dried lignocellulose-containing material, pressing the mat into a board in a steam injection press, conditioning the board by drawing a predetermined volume of air having a predetermined moisture content at a predetermined temperature through the board by means of suction applied through the board, and grinding the conditioned board to a final thickness directly following the conditioning step. In a preferred embodiment, the conditioning of the board comprises a first conditioning of the board by drawing a first predetermined volume of air having a first predetermined moisture content at a first predetermined temperature through the board in a first direction by means of suction applied through the board, and including a second conditioning of the board by drawing a second predetermined volume of air having a second predetermined moisture content at a second predetermined temperature through the board in a second direction by means of suction applied through the board, wherein the second direction is opposite to the first direction.

[0008] In accordance with one embodiment of the method of the present invention, the pressing of the mat into the board provides a board having a pair of surface layers and a center

layer, and wherein the pair of surface layers and the center layer have substantially the same density.

[0009] In accordance with the present invention, these and other objects have also been realized by the invention of apparatus for continuously providing lignocellulose-containing boards from a mat of disintegrated, glue-coated and dried lignocellulose-containing material, the apparatus comprising a steam injection press for pressing the mat into a board, conditioning means comprising an air supply unit for passing the air through the board as the board passes through a conditioning zone, and a grinder for grinding the conditioned board to a final thickness directly following the conditioning zone. In a preferred embodiment, the conditioning means comprises first conditioning means comprising a first air supply unit for passing the air through the board in a first direction and including second conditioning means comprising a second air supply unit for passing the air through the board in a second direction, the second direction being opposite to the first direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present invention will now be described in more detail with reference to the following detailed description which, in turn, refers to the accompanying drawing, in which:

[0011] The figure is a side, elevational, ~~schematic~~ longitudinal sectional view of a plant constructed in accordance with the present invention.

DETAILED DESCRIPTION

[0012] The plant illustrated in the drawing is based on the plant disclosed in Swedish Patent No. 504,638~~SE 504 638~~, which describes a continuous steam injection process. Turning to the drawing, a ~~A~~ mat 1 formed from lignocellulose-containing material is fed into a continuous steam injection press 2 and ~~there~~ pressed into boards 3 therein. The boards exiting from the continuous steam injection press 2 enter an after-conditioning zone 4. In the illustrated example, the zone 4 includes two after-conditioning units, 5 and 6. The boards can

be transferred directly to a grinder 7 from the after-conditioning zone 4, for grinding of the board to a final thickness.

[0013] In accordance with the present invention, each after-conditioning unit, 5 and ~~,~~ 6, comprises an air supply unit 8 that includes a suction fan 9 and a heater 10. A steam or water supply device 11 may also be provided for moistening the air. The air is sucked into the two air supply units at 12. As will be seen from the drawing, the air is delivered from above in the case of ~~the~~ after-conditioning unit 5, and from beneath in the case of ~~the~~ after-conditioning unit 6.

[0014] Thus, as the boards exit from the continuous steam injection press 2 they pass into the after-conditioning zone 4 in which air is sucked through the boards with the aid of negative pressure in an amount determined in relation to board production and at a specific moisture content and temperature. In the first after-conditioning unit 5, the air is sucked down through the board, whereas in the after-conditioning unit 6 the air is sucked through the board in the opposite direction, i.e. upwards. However, this double air flow in mutually opposite directions is not necessary in order to achieve the desired ~~an~~ effect, since in certain cases the throughflow of air in only one direction will suffice, meaning that only one after-conditioning unit will be required.

[0015] It can be mentioned by way of example that a board having a density of 600 kg/m^3 and a thickness of 16.6 mm is cooled from 100 to 60°C in 60 seconds when applying a subpressure of 15 kPa. By way of another example, ~~it can be mentioned that~~ a board having a density of 600 kg/m^3 and a thickness of 32 mm can be ~~is~~ correspondingly cooled in 80 seconds.

[0016] It will also be noted that a board having a thickness of 10 mm and a density of 650 kg/m^3 and produced in accordance with the present invention in a pilot plant obtained a stable thickness after having passed through the after-conditioning zone. Measurements made one or more days

after manufacture showed that boards which had passed through the after-conditioning zone retained their thickness, whereas boards that had not passed through ~~said~~ that zone were often liable to shrink up to 1 mm within a day or two, in the same way ~~as~~ that conventionally manufactured board also shrinks.

[0017] Conventionally produced boards have an enhanced density at their surfaces. However, because it is possible to produce boards in the steam injection press ~~boards~~ that do not have an enhanced surface density, the air throughflow and therewith conditioning of the board and lowering of its temperature can be effected more quickly than in the case of conventional board handling techniques.

[0018] Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.

METHOD AND ARRANGEMENT FOR THE PRODUCTION OF LIGNOCELLULOSE-CONTAINING BOARDS

The present invention relates to a method of producing continuously lignocellulose-containing boards in accordance with the preamble of claim 1, and to an arrangement for carrying out the method in accordance with the preamble of claim 5.

Methods of producing lignocellulose-containing board are well known to the art and have found wide use in practice. The manufacture of such boards includes the following main method steps: disintegration of the raw material into particles and/or fibres of appropriate size, drying the particles and/or fibres to a determined moisture quotient and glue-coating the material either prior to or subsequent to said drying process, shaping the glue-coated material to form a mat, which may comprise several layers, and optionally cold pre-pressing the mat, preheating said mat, water-spraying mat surfaces, etc., and heat pressing the mat in a discontinuous press or in a continuous press while subjecting the material simultaneously to pressure and heat so as to obtain a finished board. It is difficult to control the quality of the boards produced in accordance with this known method with respect to the moisture content, temperature and dimensional stability of the boards. When the boards leave the heat pressing in the production process, they have a temperature in excess of 100°C and a corresponding vapour pressure. The temperature of the board surfaces falls rapidly to beneath 100°C as the enclosed moisture is vaporised by virtue of a so-called flash effect. The boards are then cooled in so-called cooling wheels. As a result, the boards will obtain a moisture content of about 6-7% after intermediate storage of the board over a day or two. In many applications this creates a problem in environments that have a higher average relative humidity, since the boards will take up moisture when used and therewith undergo dimensional changes, as in the case of all lignocellulose-containing materials. One way of counteracting this is to spray water on the boards as they leave the press.

Another known phenomena is that boards produced in this way obtain mutually different moisture contents in the surface layers relative to the core layer.

If the boards are used for some type of surface treatment for instance, such as lamination, without having earlier equalised the difference in moisture content, the dimensions of the board may change when this equalisation takes place in time so that the surface layer loosens. In order to achieve desired equalisation between the various layers, it is customary to store the boards for a number of weeks.

Another known problem is that the boards are not dimensionally stable when they leave the press. This is noticeable primarily because the boards shrink or swell over a process that can take one or more days. Consequently, calibration grinding of the boards is not normally undertaken until the boards have been stored in intermediate storage locations over a number of days.

Another known problem is that the boards are too hot to be stacked and stored when leaving the hot press. If the boards are too hot when stacked, the glue joints may begin to break down and the boards consequently weakened. This problem is normally alleviated by keeping the boards in a so-called cooling wheel in which the board temperature is lowered by natural convection.

It will be evident from the aforegoing that the conventionally used press technique and board production technique involve a number of cost-inducing handling stages and intermediate storage subsequent to the actual board manufacturing process. Accordingly, the object of the present invention is to stabilise a board with respect to its moisture content, temperature and dimensional stability in a continuous process, and therewith avoid cost-inducing handling and storage of the board. Because dimensional stability is achieved, the boards may also be ground or sanded down to a final thickness directly after manufacture. This object is achieved with the method and the apparatus defined in the characterizing clauses of respective claims.

The invention will now be described in more detail with reference to the accompanying drawing, which is a schematic longitudinal section view of plant constructed in accordance with the invention.

The plant illustrated in the drawing is based on the plant disclosed in SE 504 638, which describes a continuous steam injection process. A mat 1 formed from lignocellulose-containing material is fed into a continuous steam injection press 2 and there pressed into boards 3. The boards exiting from the continuous

steam injection press 2 enter an after-conditioning zone 4. In the illustrated example, the zone 4 includes two after-conditioning units 5 and 6. The boards can be transferred directly to a grinder 7 from the after-conditioning zone 4, for grinding of the board to a final thickness.

In accordance with the invention, each after-conditioning unit 5, 6 comprises an air supply unit 8 that includes a suction fan 9 and a heater 10. A steam or water supply device 11 may also be provided for moistening the air. The air is sucked into the two air supply units at 12. As will be seen from the drawing, the air is delivered from above in the case of the after-conditioning unit 5, and from beneath in the case of the after-conditioning unit 6.

Thus, as the boards exit from the continuous steam injection press 2 they pass into the after-conditioning zone 4 in which air is sucked through the boards with the aid of negative pressure in an amount determined in relation to board production and at a specific moisture content and temperature. In the first after-conditioning unit 5, the air is sucked down through the board, whereas in the after-conditioning unit 6 the air is sucked through the board in the opposite direction, i.e. upwards. However, this double air flow in mutually opposite directions is not necessary in order to achieve an effect since in certain cases the throughflow of air in only one direction will suffice, meaning that only one after-conditioning unit will be required.

It can be mentioned by way of example that a board having a density of 600 kg/m^3 and a thickness of 16.6 mm is cooled from 100 to 60°C in 60 seconds when applying a subpressure of 15 kPa. By way of another example, it can be mentioned that a board having a density of 600 kg/m^3 and a thickness of 32 mm is correspondingly cooled in 80 seconds.

It will also be noted that board having a thickness of 10 mm and a density of 650 kg/m^3 and produced in accordance with the invention in a pilot plant obtained a stable thickness after having passed through the after-conditioning zone. Measurements made one or more days after manufacture showed that boards which had passed through the after-conditioning zone retained their thickness, whereas boards that had not passed through said zone were often liable to shrink

up to 1 mm within a day or two, in the same way as conventionally manufactured board shrinks.

Conventionally produced boards have an enhanced density at their surfaces. However, because it is possible to produce in the steam injection press boards that do not have an enhanced surface density, the air throughflow and therewith conditioning of the board and lowering of its temperature can be effected more quickly than in the case of conventional board handling techniques.

CLAIMS

1. A method of continuously producing lignocellulose-containing board in which the material is disintegrated into particle and/or fibre form, glue-coated, dried and formed into a mat (1) which is pressed into board form (3) in a continuous steam-injection press (2), and in which the board is thereafter passed through an after-conditioning unit (4), **characterized** by drawing a determined volume of air of given moisture content and temperature through the board in the after-conditioning zone (4) by suction, and grinding the board (3) to a final thickness directly after having left the after-conditioning zone (4).

2. A method according to claim 1, **characterized** in that said air is first sucked through the board (3) in one direction and then in the opposite direction.

3. A method according to claim 1 or 2, **characterized** in that the surface layers of the board (3) are given the same density as that of the centre layer in the steam injection press.

4. An arrangement for applying the method according to any one of claims 1 - 3 and comprising a steam injection press (2) and an after-conditioning zone (4), **characterized** in that the after-conditioning zone (4) includes at least one after-conditioning unit (5) that has an air supply unit (8) for the passage of air through a by-passing board, and in that a grinding machine (7) is positioned downstream of the after-conditioning zone (4) and functioning to grind the board (3) to its final thickness.

5. An arrangement according to claim 4, **characterized** in that the after-conditioning zone (4) includes two after-conditioning units (5 and 6) which are each provided with an air supply unit for the passage of air through said board (3) from mutually opposite directions.

AMENDED CLAIMS

[received by the International Bureau on 30 June 2000 (30.06.00);
original claims 1-7 replaced by new claims 1-5 (1 page)]

1. A method of continuously producing lignocellulose-containing board in which the material is disintegrated into particle and/or fibre form, glue-coated, dried and formed into a mat (1) which is pressed into board form (3) in a continuous steam-injection press (2), and in which the board is thereafter passed through an after-conditioning unit (4), **characterized** by drawing a determined volume of air of given moisture content and temperature through the board in the after-conditioning zone (4) by suction, and grinding the board (3) to a final thickness directly after having left the after-conditioning zone (4).

2. A method according to claim 1, **characterized** in that said air is first sucked through the board (3) in one direction and then in the opposite direction.

3. A method according to claim 1 or 2, **characterized** in that the surface layers of the board (3) are given the same density as that of the centre layer in the steam injection press.

4. An arrangement for applying the method according to any one of claims 1 - 3 and comprising a steam injection press (2) and an after-conditioning zone (4), **characterized** in that the after-conditioning zone (4) includes at least one after-conditioning unit (5) that has an air supply unit (8) for the passage of air through a by-passing board, and in that a grinding machine (7) is positioned downstream of the after-conditioning zone (4) and functioning to grind the board (3) to its final thickness.

5. An arrangement according to claim 4, **characterized** in that the after-conditioning zone (4) includes two after-conditioning units (5 and 6) which are each provided with an air supply unit for the passage of air through said board (3) from mutually opposite directions.

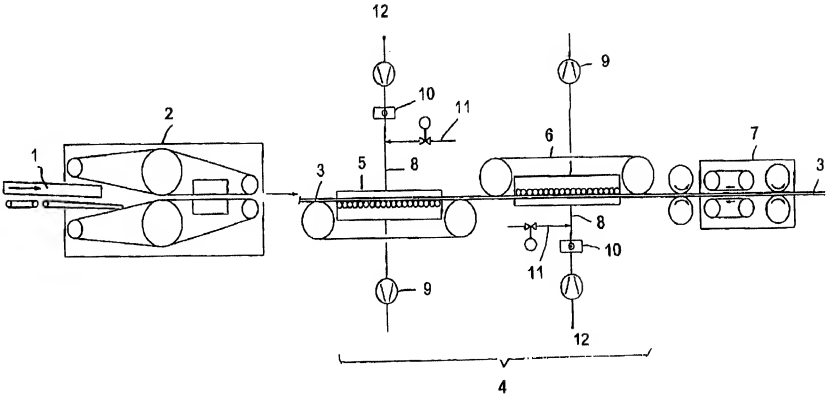

Fig. 1

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION

ATTORNEY'S DOCKET NO.: LAGROTH-026

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: METHOD AND ARRANGEMENT FOR THE PRODUCTION OF LIGNOCELLULOSE-CONTAINING BOARDS, the specification of which

☐ is attached hereto

☒ was filed on 31 January 2000 as United States Application Number or PCT International Application Number PCT/SE00/00187 and was amended on 30 June 2000 (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

COUNTRY	APPLICATION NUMBER	DATE OF FILING (month, day, year)	PRIORITY CLAIMED
Sweden	9900332-9	Feb. 1, 1999	YES ☒ NO ☐
			YES ☐ NO ☐
			YES ☐ NO ☐

LISTING OF FOREIGN APPLICATIONS CONTINUED ON PAGE 3 HEREOF ☐ YES ☒ NO

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

Application Number: _____ Filing Date: _____

Application Number: _____ Filing Date: _____

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

U.S. Parent Application Serial Number: _____ Parent Filing Date: _____ Parent Patent No.: _____

U.S. Parent Application Serial Number: _____ Parent Filing Date: _____ Parent Patent No.: _____

PCT Parent Number: _____ Parent Filing Date: _____

LISTING OF US APPLICATIONS CONTINUED ON PAGE 3 HEREOF: ☐ YES ☒ NO

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

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DECLARATION -- Page 2

ATTORNEY DOCKET NO. LAGROTH-026

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

100

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Fourth Inventor's signature _____ **Date** _____

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Full name of sixth joint inventor, if any (given name, family name): _____

Sixth Inventor's signature _____ **Date** _____

Residence: _____ Citizenship: _____

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Full name of seventh joint inventor, if any (given name, family name): _____

Seventh Inventor's signature _____ **Date** _____

Residence: _____ Citizenship: _____

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Full name of eighth joint inventor, if any (given name, family name): _____

Eighth Inventor's signature _____ **Date** _____

Residence: _____ Citizenship: _____

Post Office Address: _____

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